

Properties and Classifications of Matter

PS-3 The student will demonstrate an understanding of various properties and classifications of matter.

PS-3.2 Infer the practical applications of organic and inorganic substances on the basis of their chemical and physical properties.

Taxonomy Level: 2.5-B Understand Conceptual Knowledge

Key Concepts:

Organic substances: biological molecules - protein, carbohydrate, lipid; hydrocarbons - polymers

Inorganic substances

Previous/Future knowledge: Students have not been introduced to this topic in any previous grade. Distinguishing between organic and inorganic substances is a foundation for an understanding of two major areas of chemistry.

It is essential for students to

- Select the best substance for a particular function when given a list of the substance's chemical and physical properties.
- Understand that all organic substances are compounds that contain carbon, and that inorganic substances are elements or compounds (that do not necessarily contain carbon).

Organic Substances

- Understand that the functions of substances are dictated by their properties. Recall the names of selected types of organic *biological molecules* and summarize how their functions in organisms are dictated by their chemical properties. Examples include:
 - *Protein* molecules are long chains of small units (amino acid monomers) that are arranged in various configurations so they can form a wide variety of molecules. Proteins serve many varied functions in living organisms such as catalysts (enzymes) and tissue building.
 - *Carbohydrate* molecules (sugars and starches) provide organisms with energy when they break down into smaller molecules.
 - *Lipid* molecules (fats and oils) are good sources of stored energy because lipids produce more energy per gram than carbohydrates.-
- Recall that *hydrocarbons* are a class of organic molecules composed of the elements carbon and hydrogen. Carbon and hydrogen can combine to make thousands of different hydrocarbon compounds.
 - Recognize that many hydrocarbons are combustible so they are used for fuel, including gasoline, kerosene, jet fuel, and diesel oil.
 - Recognize that many hydrocarbons form long chain molecules called *polymers* so they are used to make plastics and synthetic fibers.

Inorganic Substances

- Recognize potential uses of inorganic substances when given the properties of the substance. Examples include:
 - Copper is ductile and conducts electricity, so it is used in wiring.
 - Aluminum has a low density compared to substances with similar strength, so it is used in making airplanes.
 - Water is a good solvent for many compounds, so it is used to wash clothes.
 - Argon is an inert/stable gas that will not react with the filament, so it is used in light bulbs.

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It is not essential for students to

- Recall the structural formulas of organic compounds.
- Recall organic nomenclature.

Assessment Guidelines:

The objective of this indicator is to *infer* applications of organic and inorganic substances based on physical and chemical properties, therefore, the primary focus of assessment should be to choose an appropriate substance for a particular practical application when presented with the chemical and physical characteristics of several substances or to determine the chemical and physical properties that a substance would need to have in order to be useful for a particular practical application.

In addition to *infer*, assessments may require students to

- *Classify* substances as organic or inorganic when given a description of the components of the compound (based on the presence or absence of carbon);
- *Exemplify* the use of organic and inorganic substances based on their properties;
- *Summarize* how the practical applications of organic and inorganic substances.